Stoller
Grand Junction Office established 1959

GJO-2004-586-TAC

C4211
Log Data Report

Borehole Information:

Borehole: C4211			**Site:** 216-U-1 and U-2 Cribs		
Coordinates (WA State Plane)		**GWL (ft)[1]:** Dry		**GWL Date:**	02/10/2004
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
Not Available	Not Available	Jan. 2004	Not Available	50	Push Hole

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	0	6 5/8	5 1/2	9/16	0	50
The logging engineer measured a sample of casing located in a lay-down area next to the borehole. Outside and inside casing diameters were measured using a caliper and a steel tape. The measurements were rounded to the nearest 1/16 in.						

Borehole Notes:

This push-hole is located along the southwest side of the crib. Using an acoustic depth device, depth-to-bottom measured 50.0 ft from top-of-casing. Zero reference is the ground surface.

Logging Equipment Information:

Logging System:	Gamma 1E		**Type:** SGLS (70%) 34TP40587A
Calibration Date:	01/2004	**Calibration Reference:**	GJO-2004-568-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	**1**	**2**	**3 / Repeat**		
Date	02/10/04	02/10/04	02/10/04		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	49.50	48.5	15.5		
Finish Depth (ft)	49.50	0.5	10.5		
Count Time (sec)	100	100	100		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A[3]	N/A	N/A		
Pre-Verification	AE081CAB	AE081CAB	AE081CAB		
Start File	AE082000	AE082001	AE082050		
Finish File	AE082000	AE082049	AE082055		
Post-Verification	AE082CAA	AE082CAA	AE082CAA		

Log Run	1	2	3 / Repeat		
Depth Return Error (in.)	N/A	-1	0		
Comments	Sonde tip is on casing bottom.	No fine-gain adjustment.	Repeat section.		

Logging Operation Notes:

Zero reference was ground surface. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118.

Analysis Notes:

Analyst:	Sobczyk	Date:	2/13/04	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. The peak counts per second (cps) at the 609-keV and 1461-keV photopeaks on the post-run verification spectrum as compared to the pre-run verification spectrum for each day were between 2.3 percent lower and 2.5 percent higher at the end of the day. The peak counts per second at the 2615-keV photopeak on the post-run verification spectrum as compared to the pre-run verification spectrum was 19 percent higher at the end of the day. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1EJan04.xls). Zero reference was the ground surface. Based on the field measurements, the casing configuration was assumed as one string of 6-in. casing with a thickness of 9/16 in. to 49.5 ft (total logging depth). The dead time and water corrections were not required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 609 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 1764 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected in the interval between 1.5 and 10.5 ft with concentrations ranging from the MDL (0.2 pCi/g) to 9.7 pCi/g. The maximum concentration was measured at 2.5 ft.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV and for ^{137}Cs at 662 keV. ^{137}Cs was

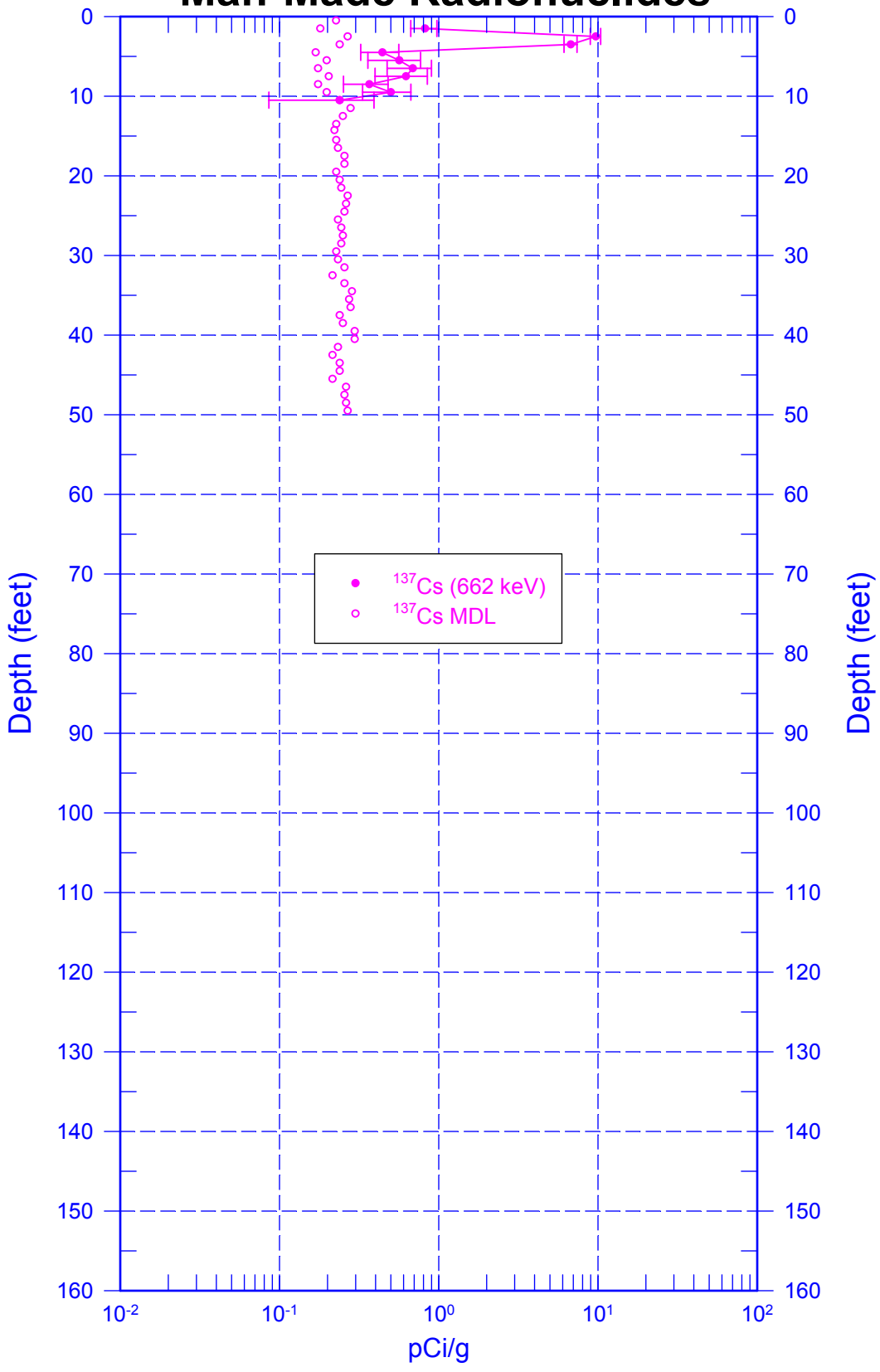
detected at 11.5 ft with a concentration near the MDL on the repeat log run, while ^{137}Cs was not detected at this depth on the original log run.

---

[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

C4211

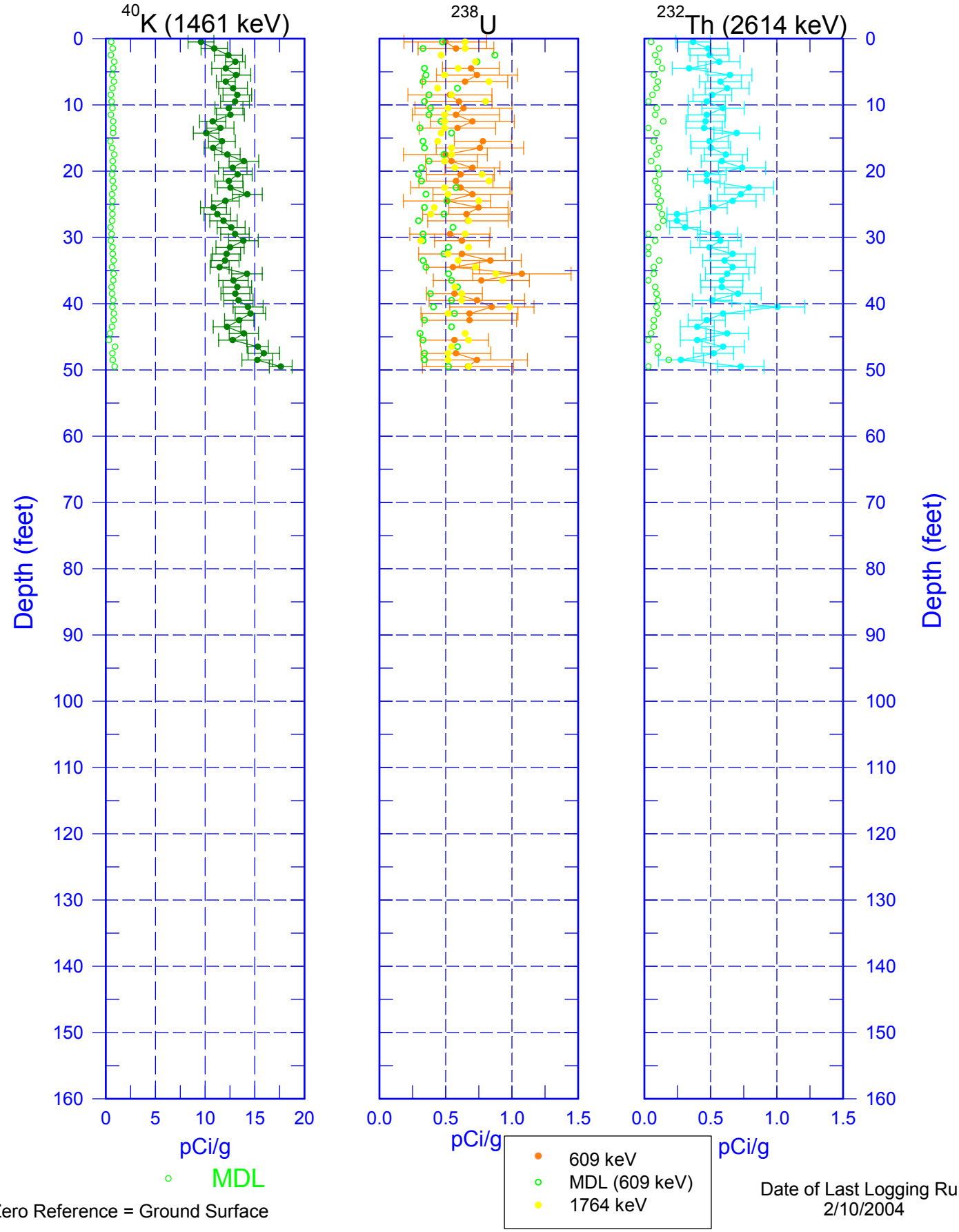
Man-Made Radionuclides



Zero Reference = Ground Surface

Date of Last Logging Run
2/10/2004

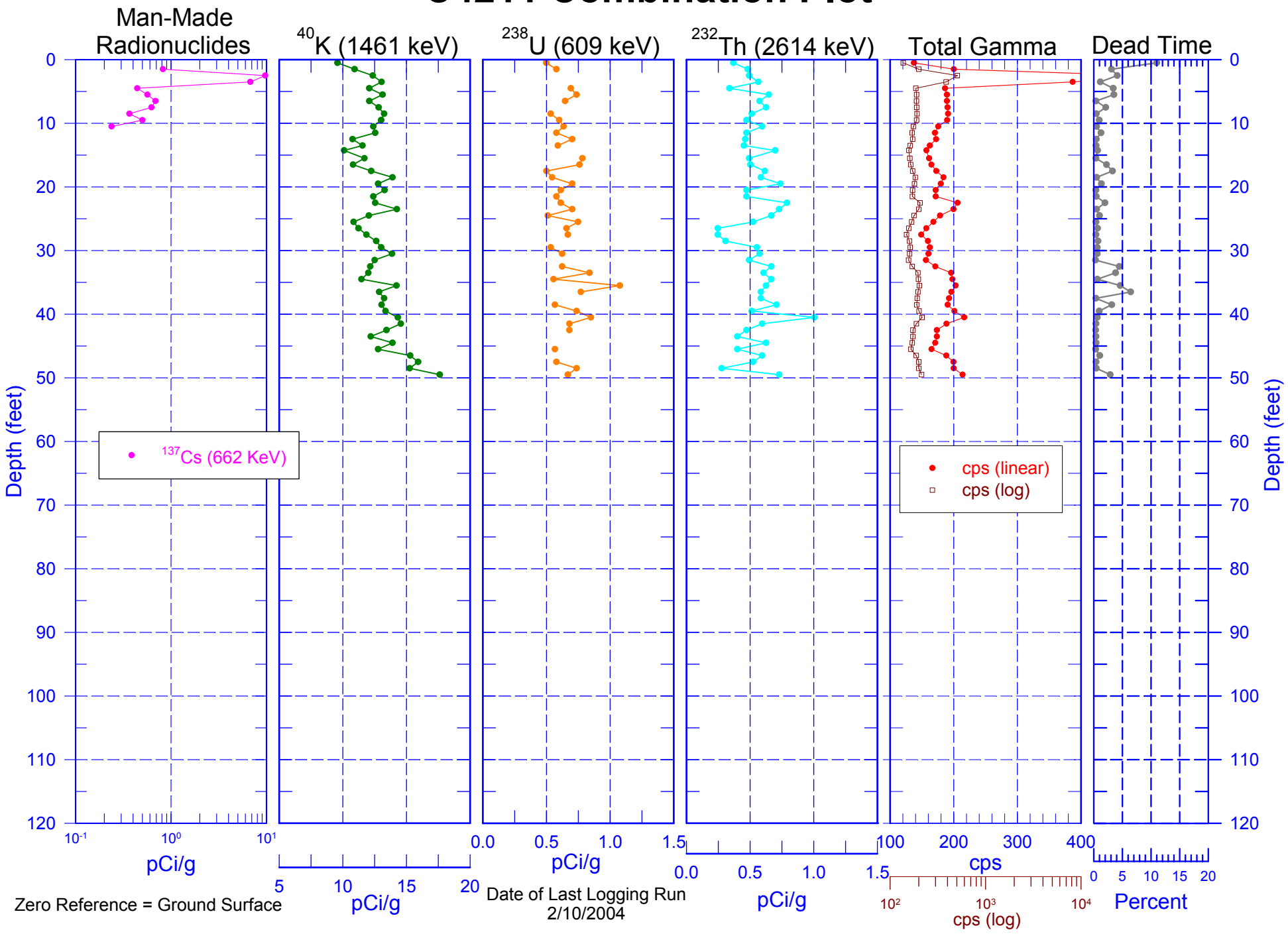
C4211
Natural Gamma Logs



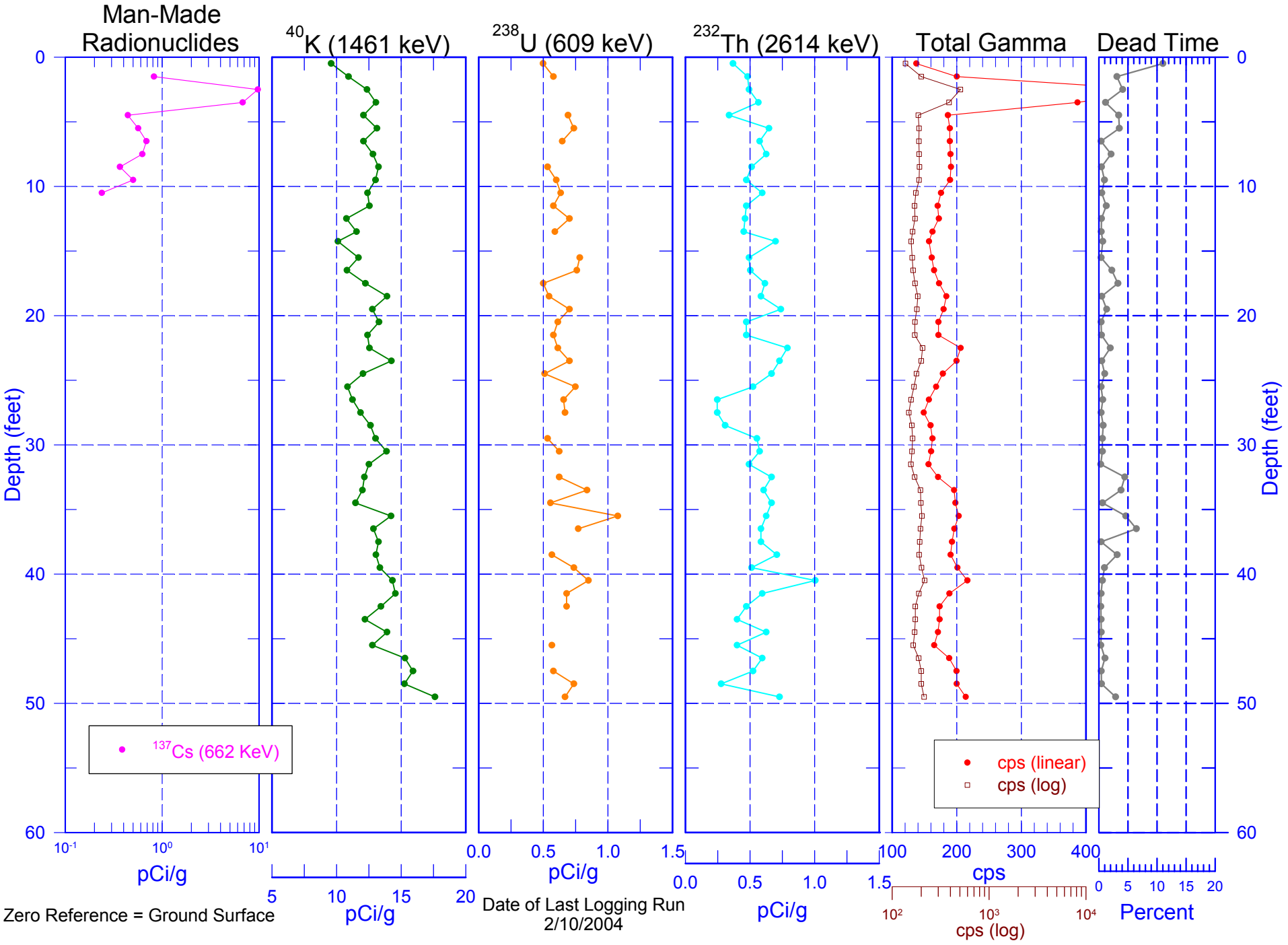
Zero Reference = Ground Surface

Date of Last Logging Run
2/10/2004

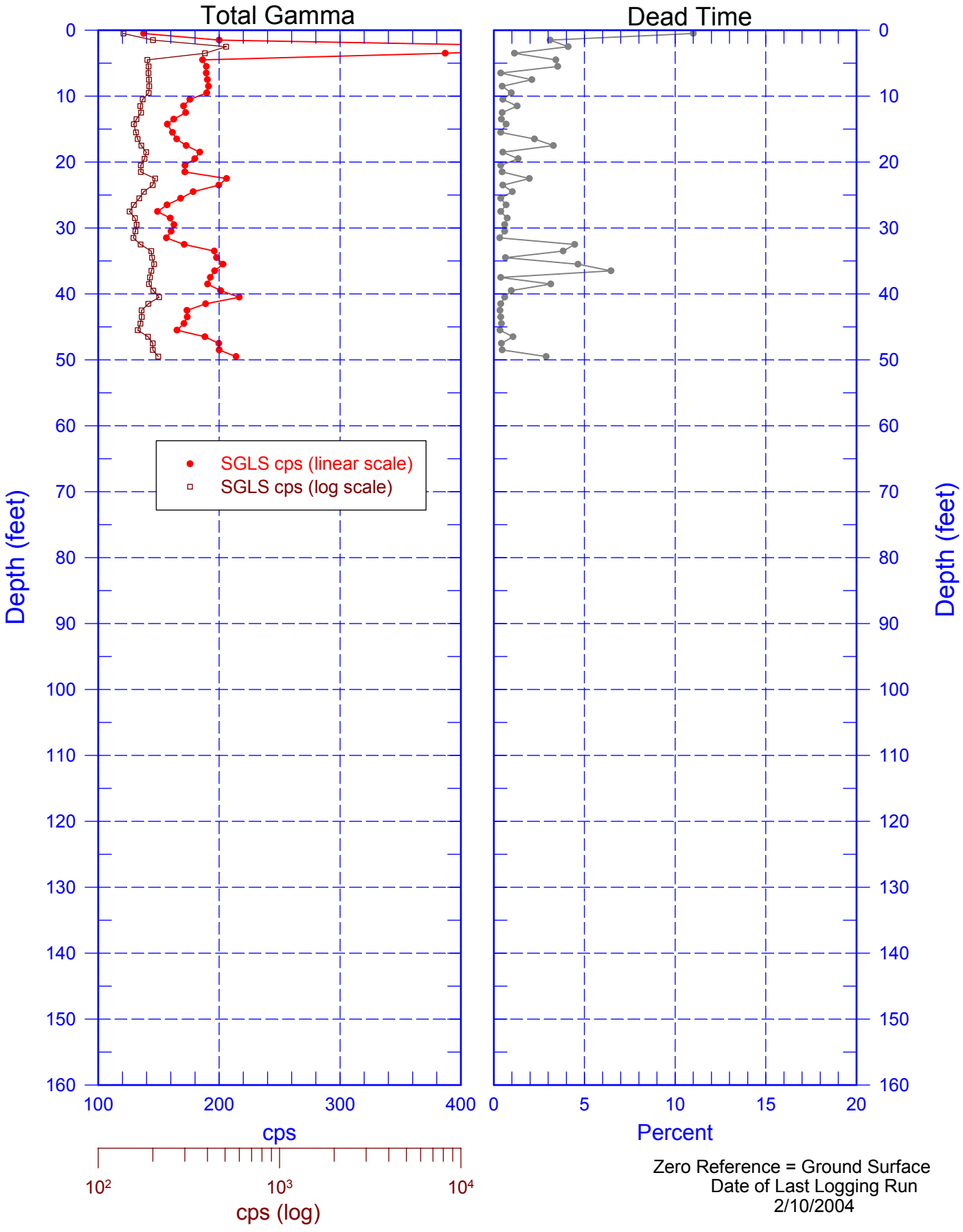
C4211 Combination Plot



C4211 Combination Plot



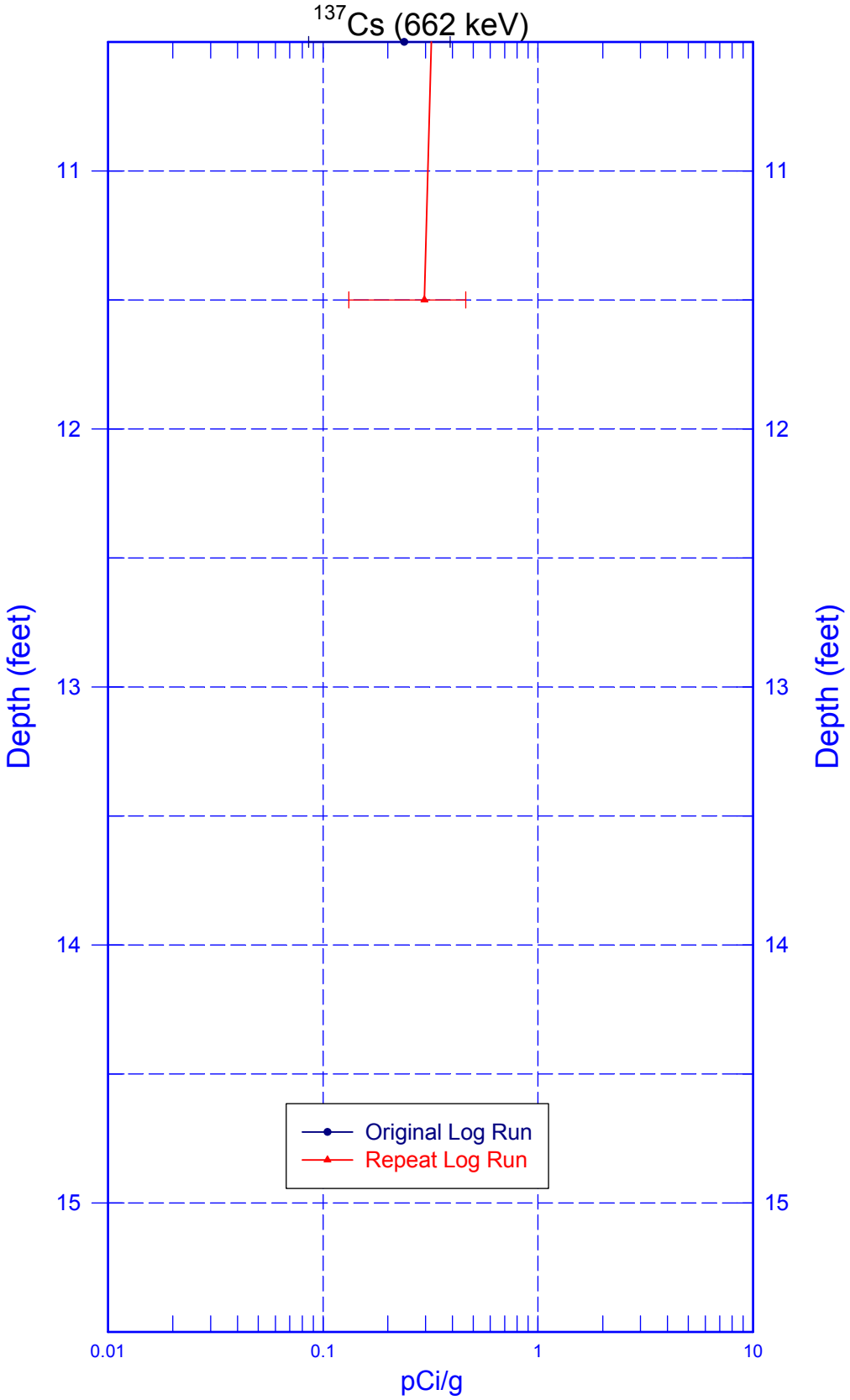
C4211
Total Gamma & Dead Time



Zero Reference = Ground Surface
Date of Last Logging Run
2/10/2004

C4211

Rerun of Man-Made Radionuclides



C4211

Rerun of Natural Gamma Logs (15.5 to 10.5 ft)